
PART 3: WOLF RIVER BASIN OUTSIDE OF THE NRA

Geology and Vegetation

In the northern and western part of the Wolf River basin, end and ground moraines surrounded by pitted outwash cover the majority of the landscape. Numerous small kettles containing lakes and peat bogs are embedded within these landforms. Due to the climate and the hilly, morainal topography in the northern and western portions of the basin, forest cover is greater than in the southeast, and forestry gains in importance relative to agriculture. Ecological Landscapes represented in these portions of the basin are described in Part 1.

Summary of NHI Data from the Endangered Resources Program

Following is information on the significant natural communities and rare plants and animals that are known to exist within the Wolf River Basin outside of the NRA. This information is summarized from NHI's Biological and Conservation Data (BCD) system and includes information added to the BCD from the 2001 field inventories. Map 6 depicts the location of element occurrences (EOs) within the Wolf River Basin, and highlights those EOs resulting from 1999-2001 fieldwork. Appendices N.1, N.2, O, and P provide a full listing of all the known elements that occur within the entire basin, and include descriptions and management considerations for each.

Natural Communities

Brief descriptions of all natural communities, aquatic features, and other habitats surveyed within the basin but outside of the NRA to date can be found in Appendix N.2. The following is a list of those natural community types known to occur within the basin but outside of the NRA that have local or regional significance.

Natural community types of especially high significance because of their extent, quality or condition within the basin but outside of the NRA include:

- **Emergent Aquatic** (cattail-bulrush-bur-reed-arrowhead)
- **Emergent Aquatic** - Wild Rice
- **Submergent Aquatic** (pondweeds-wild celery-waterweed-water-milfoil)
- **Southern Sedge Meadow** (tussock sedge-Canada bluejoint grass)
- **Southern Hardwood Swamp** (red maple-elms-ashes)
- **Northern Hardwood Swamp** (black ash-red maple-yellow birch)
- **Floodplain Forest** (silver maple-green ash-swamp white oak)
- **Northern Mesic Forest** (sugar maple-hemlock-yellow birch-beech-white pine)

Natural community types which are not extensive within the basin but are significant because of their rarity statewide, their quality and condition, and/or because they provide habitat for locally or regionally rare species include:

- **Northern Wet-mesic Forest** (white cedar)
- **Oak Barrens (oaks-prairie grasses and forbs)**
- **Pine Barrens (jack pine-oaks-prairie grasses and forbs)**
- **Southern Mesic Forest** (maple-basswood terraces just above the floodplain of the Wolf River)
- **Southern Dry Forest** (white oak-black oak)
- **Northern Dry-mesic Forest** (white pine-red oak-red maple)
- **Northern Sedge Meadow** (*Carex* spp.-Canada bluejoint grass)
- **Tamarack Swamp** (tamarack-Labrador tea-sedges-mosses)
- **Open Bog** (sphagnum mosses-leatherleaf)
- **Muskeg** (sphagnum mosses-ericaceous shrubs-black spruce-tamarack)
- **Wet Prairie** (prairie cordgrass-Canada bluejoint grass)
- **Wet-mesic Prairie** (big bluestem-prairie dock)
- **Sand Prairie** (little bluestem-junegrass)

Other habitats that were occasionally surveyed that either represent cover types not included under the concept of natural communities by NHI at this time or are highly altered or degraded. Any of these types can sometimes provide important habitat for sensitive species or perform important functions such as buffering or increasing effective habitat area.

- **Restored prairie**
- **Reed canary grass meadow**
- **Aspen forest**
- **Conifer plantation**
- **Intensively managed northern hardwoods**
- **Old field**

Aquatic Communities

See Part 2 for a discussion of aquatic communities, as well as maps 7-9.

Rare Plants

The Wisconsin Natural Heritage Inventory lists 66 rare plant species in the Wolf River Basin (Table 4), outside of the NRA. Nine of the species occur also within the NRA. The species include 8 that are State Endangered, 11 that are State Threatened species, and 47 that are State Special Concern.

Two of the Wisconsin Endangered plant species, the prairie white fringed orchid and Fassett's locoweed, are listed as threatened by the federal government. Both species were documented in 2000 by botanists in the Wolf River Basin outside of the NRA. Except for squarestem spikerush, the other Wisconsin Endangered plants (purple milkweed, little goblin moonwort, small yellow water crowfoot, dwarf huckleberry, and mountain cranberry) have been documented in the Wolf River Basin in the last twenty years.

Fassett's locoweed is considered to be a globally critically imperiled species due to the small number of known populations and the fragility of its habitat. The prairie white-fringed orchid is a globally imperiled (G2) species, and the little goblin moonwort and ram's-head lady's-slipper are considered rare throughout their ranges (G3). The remaining 62 tracked plant species are considered globally secure (G4, G5).

Table 4. Rare Plants of the Wolf River Basin Inventory Area Outside of the NRA

<i>Scientific Name</i>	Common Name	Lastobs Year	State Status	Federal Status
<i>Adlumia fungosa</i>	Climbing fumitory	1963	SC	
<i>Amerorchis rotundifolia</i>	Round-leaved orchis	1998	THR	
<i>Arabis missouriensis</i> var <i>deamii</i> *	Deam's rockcress	1965	SC	
<i>Arethusa bulbosa</i>	Swamp-pink	1995	SC	
<i>Asclepias ovalifolia</i>	Dwarf milkweed	2000	THR	
<i>Asclepias purpurascens</i>	Purple milkweed	1984	END	
<i>Bartonia virginica</i>	Yellow screwstem	1916	SC	
<i>Botrychium mormo</i>	Little goblin moonwort	2001	END	
<i>Botrychium oneidense</i>	Blunt-lobe grape-fern	1994	SC	
<i>Calylophus serrulatus</i>	Yellow evening primrose	1915	SC	
<i>Calypso bulbosa</i>	Fairy slipper	1994	THR	
<i>Cardamine pratensis</i> *	Cuckooflower	2001	SC	
<i>Carex assiniboinensis</i>	Assiniboine sedge	2001	SC	
<i>Carex gynocrates</i> *	Northern bog sedge	2000	SC	
<i>Carex sychnocephala</i>	Many-headed sedge	2000	SC	
<i>Carex tenuiflora</i>	Sparse-flowered sedge	2000	SC	
<i>Carex vaginata</i>	Sheathed sedge	1994	SC	
<i>Ceratophyllum echinatum</i>	Prickly hornwort	1982	SC	
<i>Corallorhiza odontorhiza</i>	Autumn coral-root	2000	SC	
<i>Cypripedium arietinum</i>	Ram's-head lady's-slipper	2001	THR	
<i>Cypripedium candidum</i>	Small white lady's-slipper	1992	THR	
<i>Cypripedium parviflorum</i>	Small yellow lady's-slipper	2001	SC	
<i>Cypripedium reginae</i> *	Showy lady's-slipper	2000	SC	
<i>Deschampsia cespitosa</i>	Tufted hairgrass	1940	SC	
<i>Diplazium pycnocarpon</i>	Glade fern	2001	SC	
<i>Elatine triandra</i>	Longstem water-wort	1994	SC	
<i>Eleocharis olivacea</i>	Capitate spikerush	1977	SC	
<i>Eleocharis quadrangulata</i>	Squarestem spikerush	Unknown	END	
<i>Eleocharis quinqueflora</i>	Few-flower spikerush	1977	SC	
<i>Eleocharis robbinsii</i>	Robbins spikerush	1982	SC	
<i>Epilobium palustre</i>	Marsh willow-herb	1994	SC	
<i>Equisetum palustre</i>	Marsh horsetail	1994	SC	
<i>Equisetum variegatum</i>	Variegated horsetail	1994	SC	
<i>Glycyrrhiza lepidota</i>	Wild licorice	1915	SC	
<i>Juncus vaseyi</i>	Vasey's rush	1916	SC	
<i>Liatris spicata</i>	Marsh blazing star	2000	SC	
<i>Lithospermum latifolium</i>	American gromwell	2000	SC	
<i>Littorella americana</i>	American shore-grass	1931	SC	
<i>Malaxis brachypoda</i>	White adder's-mouth	2000	SC	
<i>Medeola virginiana</i> *	Indian cucumber-root	2001	SC	
<i>Minuartia dawsonensis</i>	Rock stitchwort	1965	SC	

Scientific Name	Common Name	Lastobs Year	State Status	Federal Status
<i>Opuntia fragilis</i>	Brittle prickly-pear	2000	THR	
<i>Oxytropis campestris</i> var <i>chartacea</i>	Fassett's locoweed	2000	END	LT
<i>Penstemon pallidus</i>	Pale beardtongue	1965	SC	
<i>Platanthera dilatata</i> *	Leafy white orchis	1995	SC	
<i>Platanthera flava</i> var <i>herbiola</i>	Pale green orchid	1970	THR	
<i>Platanthera hookeri</i>	Hooker's orchis	1916	SC	
<i>Platanthera leucophaea</i>	Prairie white-fringed orchid	2000	END	LT
<i>Platanthera orbiculata</i> *	Large roundleaf orchid	1931	SC	
<i>Potamogeton confervoides</i>	Algae-like pondweed	1994	THR	
<i>Psilocarya scirpoides</i>	Long-beaked baldrush	2000	THR	
<i>Ranunculus gmelinii</i>	Small yellow water crowfoot	1994	END	
<i>Ribes hudsonianum</i>	Northern black currant	2001	SC	
<i>Scirpus torreyi</i>	Torrey's bulrush	1994	SC	
<i>Talinum rugospermum</i>	Prairie fame-flower	2000	SC	
<i>Thalictrum revolutum</i>	Waxleaf meadowrue	2000	SC	
<i>Trillium nivale</i>	Snow trillium	2000	THR	
<i>Triglochin maritima</i> *	Common bog arrow-grass	2001	SC	
<i>Utricularia purpurea</i>	Purple bladderwort	1982	SC	
<i>Utricularia resupinata</i>	Northeastern bladderwort	1994	SC	
<i>Vaccinium cespitosum</i>	Dwarf huckleberry	1994	END	
<i>Vaccinium vitis-idaea</i> ssp <i>minus</i>	Mountain cranberry	1994	END	
<i>Valeriana sitchensis</i> ssp <i>uliginosa</i> *	Marsh valerian	2000	THR	
<i>Verbena simplex</i>	Narrow-leaved vervain	1979	SC	
<i>Viburnum cassinoides</i>	Northern wild-raisin	1973	SC	
<i>Viola rostrata</i>	Long-spur violet	1979	SC	

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*Species for which there occurrences both within and outside of the NRA

Many of the rare plants in the Wolf River Basin are associated with wetland communities. The others grow in a number of different forest communities, in prairies, on cliffs, on lakeshores, or are aquatic plants.

Of the rare plant populations documented in the Wolf River Basin, 24 grow on public lands including state wildlife areas and national forest. Of those 24, 13 rare species have been documented on state natural areas. Any future survey work may reveal a larger proportion of these species on state-managed lands.

Occurrences of two species, yellow evening primrose and tufted hairgrass, are historical and new records haven't been recently documented in the Wolf River Basin. The location data from these old records is imprecise, and the occurrences might not have been within the Basin. Additional inventory work in the vicinity of the original records would help clarify the status of these two species in the Wolf River Basin.

Botanical surveys in the Wolf River Basin updated or newly documented 56 populations of rare plants. These occurrences include, among others, records for the snow trillium, several species of orchids, a variety of sedges, 2 fern species, and cuckooflower.

A discussion of all known rare vascular plants within the Wolf River Basin is provided in Appendix O.

Rare Animals

The Wisconsin Natural Heritage Inventory lists 117 rare animals within the Wolf River Basin but outside of the NRA (Table 5). These include 9 WI Endangered species, 15 WI Threatened species, and 93 Special Concern species. Only one animal, a land snail (*Catinella gelida*) considered imperiled globally (G2), was found within the inventory area, although another 13 species are considered rare or local throughout their range (G3) were also present. The remaining rare species are considered secure (G4-G5) or their global status is unknown. From the perspective of the state of Wisconsin, 15 species from the basin are critically imperiled (S1), 49 species are imperiled (S2), and 47 species are rare or uncommon (S3). The remaining 6 species are either secure (S4), of unknown status (SU) or extirpated (SX).

In the Upper Basin, there are significant occurrences of several species and taxa. For example, the only record of the state endangered dragonfly *Somatochlora incurvata* outside of the central sands region of the state is here. Significant butterfly and moth species and numbers were found at Norrie Bog.

Inventory coverage throughout the basin has been uneven in terms of species or species groups surveyed, chronology, and geography. The Lower Wolf River and several major tributaries have been systematically sampled for mussels, fish and aquatic insects, but few other groups of animals have such systematic coverage. A number of invertebrates (mostly aquatic insects) were added to the NHI working list as a result of inventory work conducted during the 1999-2001 field seasons, as well as subsequent literature review.

A discussion of all known rare animals within the Wolf River Basin is provided in Appendix P. The methods for the fieldwork completed by each of the above scientists is included in their respective taxa reports. It is anticipated that additional surveys will be needed to fill gaps in phenology, to more thoroughly cover selected sites, to survey additional taxa (e.g., birds and rare flora), and to include additional sites identified at the Experts Workshop. Thus, these reports should be viewed as preliminary findings.

Table 5. Rare Animals within the Wolf River Basin outside of the NRA

Scientific Name	Common name	Lastobs Year	State Status	Federal Status
<i>Accipiter gentilis</i>	Northern goshawk	2000	SC/M	
<i>Acipenser fulvescens</i>	Lake sturgeon	1991	SC/H	
<i>Acris crepitans blanchardi</i>	Blanchard's cricket frog	1983	END	
<i>Aeshna tuberculifera</i>	Black-tipped darner	2000	SC/N	
<i>Aeshna verticalis</i>	Green-striped darner	1985	SC/N	
<i>Alasmodonta marginata</i>	Elktoe	1995	SC/H	
<i>Alasmodonta viridis</i>	Slippershell mussel	1991	THR	
<i>Aphredoderus sayanus</i>	Pirate perch	1970	SC/N	
<i>Ardea herodias</i>	Great blue heron	2001	SC/M	
<i>Baetisca obesa</i>	A mayfly	1999	SC/N	
<i>Boloria eunomia</i>	Bog fritillary	2000	SC/N	
<i>Botaurus lentiginosus</i>	American bittern	1994	SC/M	
<i>Brachycercus prudens</i>	A caenid mayfly	1999	SC/N	
<i>Buteo lineatus</i>	Red-shouldered hawk	2000	THR	
<i>Callophrys henrici</i>	Henry's elfin	1990	SC/N	
<i>Catinella gelida</i>	A land snail	1997	SC/N	
<i>Chlidonias niger</i>	Black tern	2000	SC/M	
<i>Chlosyne gorgone</i>	Gorgone checker spot	2000	SC/N	
<i>Cicindela patruela huberi</i>	A tiger beetle	2000	SC/N	
<i>Cicindela patruela patruela</i>	A tiger beetle	2000	SC/N	
<i>Cionella morseana</i>	Appalachian pillar	1997	SC/N	
<i>Circus cyaneus</i>	Northern harrier	2001	SC/M	
<i>Clemmys insculpta</i>	Wood turtle	1994	THR	
<i>Coturnicops noveboracensis</i>	Yellow rail	1994	THR	
<i>Diadophis punctatus edwardsii</i>	Northern ringneck snake	1998	SC/H	
<i>Emydoidea blandingii</i>	Blanding's turtle	2000	THR	
<i>Enallagma anna</i>	River bluet	1986	SC/N	
<i>Enallagma traviatum</i>	Slender bluet	2000	SC/N	
<i>Epioblasma triquetra</i>	Snuffbox	2001	END	
<i>Erimyzon sucetta</i>	Lake chubsucker	1979	SC/N	
<i>Erynnis persius</i>	Persius dusky wing	1994	SC/N	
<i>Etheostoma microperca</i>	Least darter	1979	SC/N	
<i>Euphyes bimacula</i>	Two-spotted skipper	1994	SC/N	
<i>Euphyes dion</i>	Dion skipper	2000	SC/N	
<i>Falcipecten canadensis</i>	Spruce grouse	1989	THR	
<i>Fundulus diaphanus</i>	Banded killifish	1995	SC/N	
<i>Gallinula chloropus</i>	Common moorhen	2000	SC/M	
<i>Glyphyalinia rhoadsi</i>	Sculpted glyph	1997	SC/N	
<i>Gomphurus lineatifrons</i>	Splendid clubtail	2000	SC/N	
<i>Gomphurus ventricosus</i>	Skillet clubtail	1999	SC/N	
<i>Gomphus viridifrons</i>	Green-faced clubtail	1998	SC/N	
<i>Gyrinus impressicollis</i>	A whirlygig beetle	2000	SC/N	
<i>Haliaeetus leucocephalus</i>	Bald eagle	1992	SC/FL	LT,PD
<i>Halipus leopardus</i>	A crawling water beetle	2000	SC/N	
<i>Halipus pantherinus</i>	A crawling water beetle	2000	SC/N	
<i>Hemidactylium scutatum</i>	Four-toed salamander	2000	SC/H	
<i>Hemileuca sp 3</i>	Midwestern fen buckmoth	1974	SC/N	
<i>Hesperia comma</i>	Laurentian skipper	2000	SC/N	
<i>Hesperia leonardus leonardus</i>	Leonard's skipper	2000	SC/N	
<i>Hetaerina titia</i>	Dark rubyspot	1999	SC/N	
<i>Hydrobius melaenum</i>	A water scavenging beetle	2000	SC/N	
<i>Hydrometra martini</i>	A water measurer	2000	SC/N	
<i>Hydroporus vittatus</i>	A predaceous diving beetle	2000	SC/N	
<i>Isoperla bilineata</i>	A perlid stonefly	1996	SC/N	
<i>Isoperla lata</i>	A perlid stonefly	1996	SC/N	
<i>Isoperla richardsoni</i>	A perlid stonefly	1999	SC/N	
<i>Laccobius agilis</i>	A water scavenging beetle	2000	SC/N	
<i>Laccobius reflexipennis</i>	A predaceous beetle	2000	SC/N	
<i>Lepomis megalotis</i>	Longear sunfish	1979	THR	

Scientific Name	Common name	Lastobs Year	State Status	Federal Status
<i>Lestes vigilax</i>	Swamp spreadwing	2000	SC/N	
<i>Luxilus chrysocephalus</i>	Striped shiner	UNK	END	
<i>Lycaeides idas nabokovi</i>	Northern blue butterfly	1994	END	
<i>Lycaeides melissa samuelis</i>	Karner blue butterfly	2001	SC/FL	LE
<i>Lycaena dorcas</i>	Dorcas copper	2000	SC/N	
<i>Lycaena epixanthe</i>	Bog copper	2001	SC/N	
<i>Lythrurus umbratilis</i>	Redfin shiner	1979	THR	
<i>Macrochilo bivittata</i>	An owl moth	1994	SC/N	
<i>Microtus ochrogaster</i>	Prairie vole	1898	SC/N	
<i>Moxostoma carinatum</i>	River redhorse	1982	THR	
<i>Moxostoma valenciennesi</i>	Greater redhorse	1994	THR	
<i>Nannothemis bella</i>	Elfin skimmer	1990	SC/N	
<i>Napaeozapus insignis</i>	Woodland jumping mouse	1995	SC/N	
<i>Neurocordulia yamaskanensis</i>	Stygian shadowfly	1999	SC/N	
<i>Notropis anogenus</i>	Pugnose shiner	1979	THR	
<i>Notropis texanus</i>	Weed shiner	1979	SC/N	
<i>Oeneis jutta</i>	Jutta arctic	2000	SC/N	
<i>Ophiogomphus carolus</i>	Riffle snaketail	2000	SC/N	
<i>Ophiogomphus howei</i>	Pygmy snaketail	1999	THR	
<i>Ophisaurus attenuatus</i>	Western slender glass lizard	1989	END	
<i>Opsopoeodus emiliae</i>	Pugnose minnow	1979	SC/N	
<i>Pandion haliaetus</i>	Osprey	1992	THR	
<i>Pelocoris femorata</i>	A creeping water bug	1999	SC/N	
<i>Perisoreus canadensis</i>	Gray jay	1994	SC/M	
<i>Phyciodes batesii</i>	Tawny crescent spot	2000	SC/N	
<i>Picoides arcticus</i>	Black-backed woodpecker	1994	SC/M	
<i>Pieris virginiensis</i>	West virginia white	1995	SC/N	
<i>Plauditus cestus</i>	A small minnow mayfly	2000	SC/N	
<i>Plebejus saepiolus</i>	Greenish blue	1994	SC/N	
<i>Pleurobema sintoxia</i>	Round pigtoe	1997	SC/H	
<i>Poanes massasoit</i>	Mulberry wing	2000	SC/N	
<i>Poanes viator</i>	Broad-winged skipper	2000	SC/N	
<i>Pompeius verna</i>	Little glassy wing	1991	SC/N	
<i>Protonotaria citrea</i>	Prothonotary warbler	2000	SC/M	
<i>Rana catesbeiana</i>	Bullfrog	1986	SC/H	
<i>Ranatra nigra</i>	A water scorpion	2000	SC/N	
<i>Reithrodontomys megalotis</i>	Western harvest mouse	1976	SC/N	
<i>Satyrodus eurydice fumosa</i>	Smokey eyed brown	1994	SC/N	
<i>Schinia bina</i>	Bina flower moth	1996	SC/N	
<i>Schinia indiana</i>	Phlox moth	1992	END	
<i>Simpsonia ambigua</i>	Salamander mussel	1992	THR	
<i>Somatochlora incurvata</i>	Warpaint emerald	2000	END	
<i>Sorex arcticus</i>	Arctic shrew	2000	SC/N	
<i>Sorex hoyi</i>	Pigmy shrew	1995	SC/N	
<i>Sorex palustris</i>	Water shrew	1995	SC/N	
<i>Sperchopsis tessellatus</i>	A water scavenging beetle	2000	SC/N	
<i>Spermophilus franklinii</i>	Franklin's ground squirrel	1990	SC/N	
<i>Sterna forsteri</i>	Forster's tern	1987	END	
<i>Strix nebulosa</i>	Great gray owl	1995	SC/M	
<i>Stylogomphus albistylus</i>	Least clubtail	1994	SC/N	
<i>Stylurus notatus</i>	Elusive clubtail	1999	SC/N	
<i>Stylurus scudderii</i>	Zebra clubtail	1999	SC/N	
<i>Trimerotropis maritima</i>	Seaside grasshopper	1999	SC/N	
<i>Tritogonia verrucosa</i>	Buckhorn	1995	THR	
<i>Tyto alba</i>	Barn owl	1981	END	
<i>Wormaldia moesta</i>	A caddisfly	1980	SC/N	

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Federal Status: Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened; LELT = listed endangered in part of its range, threatened in another part; PE = proposed endangered; PT = proposed threatened; PEPT = proposed endangered in part of its range threatened in another. **Group Name:** ^ = aquatic species.

PART 4 - KEY ISSUES FOR NATURAL RESOURCES AREA PLANNING

The following are ecological issues that have emerged after review of data collected during three field seasons in the Wolf River Basin. These issues were developed for use by the Department's planning team to help develop overall recommendations for the DNR properties and surrounding areas. This biotic inventory and analysis are only a part of a broader assessment that will be completed for master planning and will consolidate a variety of information to develop the overall recommendations. Site specific management issues and considerations are provided in the individual site descriptions in Appendices B (Priority Sites) and C (Priority Stream Segments). In addition, Part 5 outlines conservation needs and priorities within the NRA.

Fragmentation

When European settlement began in the Wolf River Basin, the landscape consisted of a complex mosaic of forests, savannas, prairies, and wetlands. Other communities like cliffs were embedded in this matrix created and maintained by landforms and intricate drainage patterns formed from glacial deposits, highly variable edaphic conditions, and periodic natural disturbances. Even to a casual observer, land use patterns are considerably different today than at presettlement times. As settlement proceeded, land was cleared for residential and commercial development or planted to row crops and seeded to "improved" pasture.

Riparian areas have often been viewed as desirable places to live. Settlements depended on rivers for transportation, food sources, and drinking water. Rivers were dammed for various reasons, including hydropower generation and to power gristmills, resulting in isolated populations of aquatic organisms. Not only are they a physical barrier to many aquatic organisms dams also alter and reduce habitat for many organisms, in part by changing the timing and quantity of water flow and water temperature. Today, rivers are still a desirable place to live. And in fact, in a number of places, upland shorelines have been almost completely developed in some areas for residential and recreational purposes. Development of homes, the construction of roads and utility corridors, and the alteration of the vegetation that accompanies development can affect travel corridors and greatly damage important habitat used by many species. Semi-permanently moored houseboats, or "fishing rafts," can also be found along some river stretches. These provide the ability of humans to inhabit riparian shorelines that would otherwise be off limits to human habitation.

In the past, wetlands have been viewed as an impediment, and the values and service of such communities were not recognized. Ditches were dug and wetlands tilled in an effort to support agriculture and other endeavors. In fact, drainage of wetlands has been extensive. In some counties in the lower Wolf River Basin over 30 percent of wetlands has been lost since 1961. Even with all of the efforts at conversion over the years, the largest, most intact native ecosystems persisting in the Wolf River Basin are wetland complexes within the floodplains of the Wolf River and its major tributaries. There are also several large wetland complexes within insular depressions in glacial till, outwash, and lakeplain landforms.

Planning efforts should attempt to address the causes of fragmentation and suggest viable options to minimize fragmentation in the future. Ideally, planning teams could try to develop links and corridors between existing unconnected natural communities and habitat.

Ecosystem Simplification

The structure, composition, and function of ecosystems native to the region have been significantly modified, often in ways that have led to the loss of characteristic species or other attributes. The loss of characteristic species like large carnivores, some large ungulates, and certain habitat specialists can have a ripple effect and change nutrient and mineral cycling pathways. Important functions and services may be lost from ecosystems as diverse natural communities are replaced by monocultures of agriculture. Suppression of fire has diminished or eliminated prairie and savanna habitats and their associated species due to encroachment of open habitats by woody species. Grazing and browsing pressure, both by domestic livestock and high populations of deer, have altered ecosystems by suppressing reproduction of trees, especially by those species that are preferred forage for browsers and grazers. Heavy grazing has also subjected some herbs and shrubs to pressures they cannot withstand and has resulted in losses of populations. Logging has reduced the extent of older forest successional stages, and can change successional pathways by favoring certain tree species over others. Invasive species now dominate some ecosystems, crowding out the natives and altering ecosystem function.

Extensive wetlands found along the lower portion of the Wolf River have been significantly altered by drainage, construction of impoundments, and a phenomenon called marsh recession. Wetland alterations such as ditching and diking in floodplains can diminish or even destroy habitat for specialists that depend on big rivers, backwaters, and extensive forests and marshes. Some of the fixes attempted for these problems, such as rough fish control or rip-rapping of eroding shorelines, may actually further simplify native ecosystems. While rip-rap may benefit a few fish species, studies have shown that the overall fish assemblage quality is lower on rip-rapped sites. Rip-rap is often placed on sandy eroding banks resulting in the loss of habitat for nesting river turtles and bank burrowing birds that rely on the increasingly scarce open sandy bank habitat. Eventually, rip-rap will alter the dynamics of river morphology and development.

Lakes in the Basin have been subjected to many stresses. In the large lakes in the lower Wolf River, faunal communities have been substantially altered by the replacement of mayflies and native fish as dominants, to midges and non-native fish.

Planning could reduce ecological simplification by identifying and prioritizing high quality natural communities, promoting the restoration of degraded communities, and advocating the reconstruction of extirpated communities. The restoration of sandy river banks and alternatives to the use of rip-rap could be explored.

Invasive Species

Invasive species are increasingly being recognized as serious management concerns. Invasive species are often not native to Wisconsin, but there are also non-native aggressive strains of native species, such as common reed (*Phragmites australis*) and reed canary grass (*Phalaris arundinacea*), that are capable of rapidly and greatly expanding their dominance. As invasive species become established in natural communities, they can out-compete and displace native species leading to an impoverished ecosystem. Wetlands seems to be subject to many invasives including those that are particularly difficult to control such as reed canary grass, common reed, purple loosestrife, glossy buckthorn, and flowering rush. Forests can be overwhelmed by invasive species like common buckthorn, several honeysuckle species, and garlic mustard. Aquatic systems are not immune and can be infested by animals like carp and rusty

crayfish and plants like Eurasian milfoil. Zebra mussels are a significant, but yet unrealized, threat to any warmwater firm-bottomed aquatic habitat in the lower Wolf River Basin.

Managers and resource planners could identify infestations of invasive species and work to eradicate or control those outbreaks. As new populations of invasives are identified, they could be targeted for control action early before they become widespread. Among others, local governments, landowner associations, and individual landowners could be supplied with current information about the most effective methods of control and encouraged to eliminate invasive species on their properties.

Hydrological Manipulation

There are at least 196 dams impounding a minimum of 18,000 acres in the Wolf River Basin. By far, the majority of these are on streams west of the Wolf River. At least 17 dams are within the Lower Wolf River Bottomlands NRA. Dam heights in the Basin range from one to 38 feet. Some of these dams are operated to maximize production of electricity, or so that spring flood levels are minimized. The net result is that natural fluctuations in the flow regime have been changed thereby affecting natural communities and species that require seasonal fluctuations. Formerly continuous aquatic habitats are fragmented into disjunct segments, preventing the movements of some species between different stretches of streams.

The effects of dams and their water regimes on rare species and natural communities are well documented. Recommendations for the management of dams that would emphasize compatibility between biological diversity and dam operation could be developed. As dams come up for re-licensing, each could be evaluated for their continued need.

Water Quality

Water quality in the lower Wolf River Basin has declined markedly since the advent of intensive farming, residential development, and industrialization. Many point sources of organic and chemical pollutants have been identified and subsequently addressed. However, nonpoint source pollutants, such as those resulting from lawn fertilization or maintaining roads in the winter, remain a significant threat to aquatic diversity in the Wolf River Basin.

Landowners and managers could be encouraged to use practices that minimize pollutants that adversely affect water quality. Efforts could be made to maintain adequate upland buffers and vegetation.

Multiple Ownerships

Ownership within the Wolf River Basin is predominantly private with limited public ownership. Additionally, most of the tribally owned Menominee reservation is in the Wolf River Basin. DNR properties within the Basin include state natural areas, state wildlife areas, fishery management areas, state parks, state trails, and tower sites. There is some national forest land in the northern part of the Basin. The public lands contain a modest percentage of the area's representative natural communities and rare species. As an illustration, the Wolf River corridor is the biologically richest portion of the lower Basin, but DNR-owned properties are scattered along its length and have few connecting corridors resulting in less direct influence on management decisions for large areas.

The high percentage of private ownership represents both a challenge and an opportunity for managing landscapes and developing a long-term conservation plan. Opportunities may exist for managing and linking high quality sites by engaging private landowners with a variety of conservation and protection alternatives.

PART 5: CONSERVATION NEEDS AND PRIORITIES

To ensure long-term viability for some of the sensitive plants, animals, natural communities, and aquatic features within the NRA we are recommending the natural features listed in this section as priority considerations for conservation. These recommendations are not intended to devalue or exclude other priorities such as providing additional recreational opportunities, enhancing populations of game species, or providing public access; rather, they are meant to emphasize ecological considerations that are particularly important in the Lower Wolf Basin, based on survey work conducted by BER.

Floodplain Forest

Increased protection for floodplain forest will create ecological linkages and dispersal corridors between existing managed properties, promote long-term enhancement of water quality, and provide essential habitat for sensitive forest interior species and numerous other native plants and animals. No other locations in eastern Wisconsin offer comparable opportunities in terms of scale or overall quality. Larger stands of intact, older forest within the NRA would be the top priorities, particularly where such stands adjoin other valuable features such as marsh or sedge meadow communities, oxbow ponds, or running sloughs. Especially important sites to consider (and priority site numbers from Appendix B) include Wolf River Corridor – Shaw’s Landing to Fremont (17), Mosquito Hill – Liberty Bottoms (16), Leeman Bottoms (2), Outagamie Bottoms (8), Maine Bottoms (6), Lower Embarrass River Bottoms (10), and S&M Bottoms (15).

Marsh – Emergent and Submergent Types

These communities are well represented in the lower basin by large occurrences of good quality marshes. They provide critical habitat for waterfowl, terns, bitterns, rails, and many other marsh inhabitants. Many rare birds are resident in the marshes of the lower Wolf River Basin. Important sites include Lower Wolf River Marshes (20), Rat River (19), Clark’s Point (23), Piacenza Marsh (22), Poygan Islands (24), and the Wolf River Corridor – Shaw’s Landing to Fremont (17), especially on the margins of Partridge, Partridge Crop, and Cincoe Lakes.

Uncommon or Rare Community Types

These community types are uncommon or rare in the lower basin but are represented by occurrences of large size, in good condition, and/or support rare species not documented elsewhere in the lower basin. Community types and sites to consider in this category include: Northern Sedge Meadow at Winchester Meadows (21), Southern Mesic Forest at both Leeman Bottoms (2) and Lower Embarrass River Bottoms (10), and Tamarack Swamp at Wolf River Corridor – Shaw’s Landing to Fremont (17).

Buffer Areas

These areas around public lands include lands needed to facilitate management, maintain site quality, provide access, or increase the effective size of managed areas (e.g. old field grasslands adjoining marshes or sedge meadows, upland forest adjoining Floodplain Forest). Also, buffers are important along river shorelines for protecting water quality and providing additional habitat for wildlife.

Aquatic Habitats

Perhaps the most outstanding ecological features in the NRA are the many miles of large warm water stream habitat. These well-connected segments provide habitat for a large number of species, many of which are rare in eastern Wisconsin. Protecting and increasing buffers and riparian areas will contribute to overall water quality and improve aquatic habitat. However, maintaining the integrity of large rivers and streams is difficult using standard protection methods such as land acquisition, conservation easements, and management agreements alone. In order to effectively maintain or improve water quality, point and nonpoint source pollution needs to be controlled (e.g. through landowner contacts/agreements and education) and management activities on public lands that affect aquatic habitats must be carefully considered in the future. Appendix C describes four priority stream segments identified within the NRA.

FOR ADDITIONAL INFORMATION

The results of the biotic inventory provide useful information regarding the locations and habitat affinities of rare plants and animals. Our hope is that land and water managers, as well as knowledgeable biologists, can interpret the information contained in this report along with other available information to optimize management strategies for natural communities and rare species residing in the basin.

Many other sources of information regarding the management needs of rare species, as well as strategies for controlling invasive species, are available through the WDNR Bureau of Endangered Resources website (<http://www.dnr.state.wi.us/org/land/er/>) and can be used in conjunction with this report. The website will continue to post information, as it becomes available. New guides continue to be developed to assist land managers, as well as private landowners. Examples of guides that are available include the following:

- *Habitat Management Guidelines for Amphibians and Reptiles of the Midwest*. (B. Kingsbury and J. Gibson, 2002).
- *Managing Habitat For Grassland Birds: A Guide For Wisconsin* (Sample and Mossman 1997)
- *Threatened and Endangered Species in Forests of Wisconsin* (Kopitzke and Sweeney 2000).
- *Wisconsin Cerulean Warbler Recovery Plan* (Flaspohler 1993)
- *Wisconsin DNR Endangered Species Consultation for Taking Authorization for Grassland or Savanna Management on Public or Private Lands* (available online). (WDNR 2001)
- *Wisconsin Manual Of Control Recommendations For Ecologically Invasive Plants* (Hoffman and Kearns 1997)

GLOSSARY

aquatic macrophyte - vascular plants with special adaptations to aquatic habitats (lakes, streams, springs).

bog - wetlands characterized by high acidity, low nutrient availability, the accumulation of sphagnum moss peat, and a group of highly specialized vascular plants that includes ericaceous shrubs (e.g., leatherleaf, bog laurel, cranberries), sedges, and insectivorous species. By the strictest definition, a bog can receive nutrients only from precipitation, and is isolated from mineral enriched groundwater by thick beds of living sphagnum mosses and partially decomposed moss peat. "Open" bogs are those lacking a dense overstory of coniferous trees. Forested, or treed, bogs support a relatively dense growth and correspondingly closed canopy of black spruce, sometimes mixed with tamarack. See "*muskeg*."

complex – used here to reference an integrated mosaic of natural communities and/or aquatic features.

cover type – Cover typing is a generalized but sometimes useful method of broadly classifying vegetation based on the single species or species group comprising a majority of the living plants (usually commercially important trees when used in a forestry context). Cover types may also reference cultural features such as cornfields or pastures ("grass"). In cases where a clear plurality of a single species is not apparent, terms have been invented to reference groups of commonly co-occurring species, such as "northern hardwoods" (see definition below), and "swamp conifers." The terms and/or their meanings are not necessarily consistent across agency lines.

DBH – diameter at breast height (a standard height for measuring tree diameter of 4.5 ft or 1.37 m above the ground on the uphill side of the tree).

diversity - used in this report as a shortened form for biological diversity, or biodiversity. A general definition (Matthiae et al., 1993) is "the spectrum of life forms and the ecological processes that support and sustain them. Biological diversity is a complex of four interacting levels: genetic, species, community, and ecosystem."

drumlin - streamlined, teardrop shaped hills created by glacial action. The long axis parallels the direction of past glacial movement.

ecological landscape – units that have been mapped by the WDNR based on similar ecological potential and geography. This classification borrows information both from the watershed based Geographic Management Units, and the ecological classification system known as the National Hierarchical Framework of Ecological Units (NHFEU) (Avers et al. 1994).

ecoregion – geographic units that are differentiated by climate, subsurface geology, physiography, hydrology, soils, and vegetation. These units have been defined and organized in different ways by various institutions but in this document we use the National Hierarchical Framework of Ecological Units (NHFEU). As described by Avers et al (1994), the NHFEU can provide a basis for assessing resource conditions at multiple scales. In this report we have most frequently referred to "ecological landscapes" developed by the WDNR and between section and subsection in size. The boundaries generally follow section or subsection lines.

edaphic – pertaining to soil

element –the basic building blocks of the Natural Heritage Inventory. They include natural communities, rare plants, rare animals, and other selected features such as colonial bird rookeries and mussel beds. In short, an

element is any biological or ecological entity upon which we wish to gather information for conservation purposes.

element occurrence – An Element Occurrence (EO) is an area of land and/or water in which a rare species or natural community is, or was, present. An EO should have practical conservation value for the Element as evidenced by potential continued (or historic) presence and/or regular recurrence at a given location. For species, the EO often corresponds with the local population, but when appropriate may be a portion of a population (e.g., a single nest territory or long distance dispersers) or a group of nearby populations (e.g., metapopulation). For communities, the EO may represent a stand or patch of a natural community or a cluster of stands or patches of a natural community. Because they are defined on the basis of biological information, EOs may cross jurisdictional boundaries (*modified from <http://whiteoak.natureserve.org/eodraft/index.htm>*)

ericaceous – pertaining to a family of plants, the Ericaceae, especially characteristic of highly acidic habitats such as bogs and muskeg. Members include well-known plants such as blueberries, cranberries, leatherleaf, Labrador tea, and bog rosemary.

exemplary – used in this report to describe aquatic communities or organismic assemblages that are especially good representatives of their respective types. Usage of the term, while somewhat subjective, entails a comparison of like entities based on their diversity, water quality characteristics, disturbance history, and values to scientific study.

fen - wetlands that receive nutrients via direct contact with mineral enriched groundwater. A "poor" fen has very low concentrations of plant nutrients and floristically resembles a bog. A "rich" fen has relatively high concentrations of nutrients, but is still characterized by the accumulation of peat (though this is likely to be primarily from the remains of plants other than sphagnum mosses, such as sedges and brown mosses). While some plants tolerate, and in fact may thrive under, a wide range of conditions, others are quite restricted and typically occupy only a narrow range of nutrient concentrations. This last group can be useful in the identification of peatland communities.

fragmentation – the breaking up of large and continuous ecosystems, communities, and habitats into smaller discontinuous areas that are surrounded by altered or disturbed lands or aquatic features.

habitat – references those environmental attributes necessary to provide a niche that supports the needs of a species or group of species.

habitat type – all sites capable of producing similar climax plant communities. This system uses the floristic composition of a plant community as an integrated indicator of those environmental factors that affect reproduction, growth, competition, and community development. These include soils, moisture, nutrient levels, and topography. Some professional foresters in the upper Great Lakes region have begun using this system as a forest management tool. To date, this system has been developed primarily for upland forest communities.

invasive species – (Wisconsin Governor's Task Force draft definition) - A non-indigenous species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Many invasive non-indigenous species tend to be superior competitors and form monospecific stands at the expense of native species.

inventory site - also "site" in text. The geographic location at which a biological survey has been conducted. These may be large or small, depending on the nature of the species or community surveyed. Boundaries may be finite and discrete (a property boundary, a single stand of a forest community), or rather arbitrary. When sites become very large (exceeding several thousand acres) and encompass complex landscapes, they are sometimes referred to as "macrosites."

landtype association (LTA) - this level in the ecoregional hierarchy covers areas of tens to thousands of acres. Landform, soils, and vegetation are the key factors.

Lepidoptera - a large Order of insects that includes the butterflies, moths, and skippers.

macroinvertebrate - Used in the report to refer to aquatic insects and mollusks.

macrosite – two or more standard survey sites in close proximity, where consideration of their collective attributes is in some way related to the viability ecological values of the larger site.

marsh recession – used in this report to describe the loss of marsh vegetation along the shore of a lake or river, usually as a result of raised or fluctuating water levels and subsequent strong wave and ice action.

matrix - used in this document to refer to the dominant land cover within which other features of the landscape are embedded.

mesic - used by ecologists to describe site conditions that are well-drained but almost never excessively dry or inundated.

moraine - landforms composed of unsorted materials deposited by glaciers. They can cover broad geographic areas of millions of acres. Topography can vary from nearly level “till” plains to rough end moraine landscapes composed of steep dry ridges interspersed with deep kettle holes. These glacial “kettles” are frequent locations for lakes and wetlands.

MPA – methyl purple alkalinity, a measure of the carbonates, bicarbonates, and hydroxides present in water, expressed as milligrams/liter of calcium carbonate. Used to express the relative fertility of water. Low MPA are generally biologically less productive than those with higher MPA. Needs to be considered with pH and Conductivity for a proper evaluation.

muskeg – similar to “open bog.” Used to describe highly acidic peatlands characterized by a sparse growth of scattered, stunted black spruce and tamarack over ericaceous shrubs, sedges, and a deep carpet of sphagnum mosses.

National Hierarchical Framework of Ecological Units (NHFEU) – a land unit classification system developed by the U.S. Forest Service and many collaborators. As described by Avers et al (1994): “The NHFEU can provide a basis for assessing resource conditions at multiple scales. Broadly defined ecological units can be used for general planning assessments of resource capability. Intermediate scale units can be used to identify areas with similar disturbance regimes. Narrowly defined land units can be used to assess specific site conditions including: distributions of terrestrial and aquatic biota; forest growth, succession, and health; and various physical conditions.”

natural community – an assemblage of plants and animals, in a particular place at a particular time, interacting with one another, the abiotic environment around them, and subject to primarily natural disturbance regimes. Those assemblages that are repeated across a landscape in an observable pattern constitute a community type. No two assemblages, however, are exactly alike.

natural division – six major natural divisions have been delineated for the state of Wisconsin based on gross differences in vegetation, soils, and geomorphology. Recent collaborative work by the USDA Forest Service, The Nature Conservancy, the WDNR, and others has resulted in a somewhat similar but hierarchical classification system of “ecoregions.”

Natural Heritage Inventory – A system developed by the Science Division of The Nature Conservancy for collection, management, and use of biological, ecological, and related information. In Wisconsin, the Natural Heritage Inventory was established by an act of the state legislature in 1985, after which the program was installed within the WDNR’s Bureau of Endangered Resources.

northern hardwoods –generally applied to those forests of northern Wisconsin composed primarily of hardwoods such as sugar maple, basswood, ash, and birch. It is also sometimes used to refer to forests with a significant component of red maple or red oak, or sometimes even aspen, but which lack strong representation by coniferous species. The term is also in wide usage in Michigan, northern Minnesota, and other locations that have vegetation similar to that of northern Wisconsin.

old-growth – various definitions exist, but among the points they usually share in describing old-growth attributes are large living trees, standing snags, coarse woody debris, pit and mound microtopography, and

complex multi-layered canopies. Old-growth stages of many forest types were formerly common and/or widespread in northern Wisconsin but are now very rare (Frelich, 1995).

outwash - composed of materials sorted and deposited by glacial meltwaters. The resulting topography can be a level plain (“uncollapsed”) or very hilly (“collapsed” or “pitted”). Pitted outwash may contain numerous lakes, which originated when blocks of ice stranded by a receding glacier were buried within outwash deposits. As the ice melted, depressions were created that filled with water. This is the most extensive landform found on the NH-AL SF.

peat – organic deposits consisting of the partially decomposed remains of plants, which accumulate over time more rapidly than decomposition processes can break them down. Peat may be derived from the remains of mosses, sedges, or woody plants.

peatland –wetlands characterized by the gradual accumulation of peat, the partially decomposed remains of plants. Open bog, muskeg, black spruce swamp, tamarack swamp and poor fen are among the common peatland communities on the NH-AL SF.

rare– used in this report to refer to native species and natural communities known or suspected to be rare and/or declining in the state (included on NHI’s “Working List”). Included are species legally designated as “Endangered” or “Threatened” by either the State of Wisconsin or the federal government, as well as species in the Department’s advisory “Special Concern” category and on the U.S. Fish & Wildlife Service’s “Candidate” and “Species of Concern” lists.

restoration – used in this report to refer to the re-establishment of a natural community, habitat, species population, or other ecological attribute, that has been eliminated or greatly reduced on a given property or landscape. Many factors, sociological as well as ecological, must be weighed when making a decision to engage in a restoration project.

site – see “survey site.”

State Natural Area - formally designated sites that contain outstanding examples of native biotic communities, both rare types and those that are common or representative, and are often the last refuges in the state for rare and endangered species of plants and animals. Areas are devoted to scientific research, the teaching of conservation biology, and especially to the preservation of their natural values and genetic diversity for future generations. The Department of Natural Resources currently administers 326 State Natural Areas encompassing more than 120,000 acres of land and water.**survey site** – The geographic location at which a biological survey or evaluation has been conducted. Survey sites may be large or small, depending on the nature of the species or community surveyed and other factors. The boundaries of a survey site may be finite and discrete (a property boundary, the margins of a single stand of a natural community, or even the limits of a rare plant population) or rather arbitrary. When sites become very large (exceeding several thousand acres) and encompass complex landscapes they may be referenced as “macrosites.”

tension zone – a narrow region extending from northwest to southeast across Wisconsin, approximating an s-shape and separating the northern hardwood and prairie floristic provinces (Curtis 1959). This zone contains species associated with both provinces where many occur at the extent of their respective ranges.

thalweg - the deepest part of the channel cross section at any particular point on the stream

TNC - The Nature Conservancy, a private conservation organization responsible for developing the standardized methodology used by Natural Heritage programs.

xeric – characterized by excessive dryness.

SPECIES LIST

List of plant and animal species referred to by common name in the text of the report.

Common Name	Scientific Name
Alder	<i>Alnus incana</i> ssp. <i>rugosa</i>
American elm	<i>Ulmus americana</i>
American redstart	<i>Setophaga ruticilla</i>
Ant lions	<i>Myrmeleontidae</i>
Arrowhead	<i>Sagittaria</i> spp.
Aspen	<i>Populus</i> spp. (<i>P. tremuloides</i> , <i>P. grandidentata</i>)
Basswood	<i>Tilia americana</i>
Beech	<i>Fagus grandifolia</i>
Bellflower	<i>Campanula (americana)</i> spp.
Big bluestem	<i>Andropogon gerardii</i>
Bitternut hickory	<i>Carya cordiformis</i>
Black ash	<i>Fraxinus nigra</i>
Black oak	<i>Quercus velutina</i>
Black spruce	<i>Picea mariana</i>
Blanding's turtle	<i>Emydoidea blandingii</i>
Blue flag iris	<i>Iris virginica</i>
Boneset	<i>Eupatorium perfoliatum</i>
Brassy minnow	<i>Hybognathus hankinsoni</i>
Brown creeper	<i>Certhia americana</i>
Bullhead minnow	<i>Pimephales vigilas</i>
Bulrush	<i>Scirpus</i> spp.
Bur oak	<i>Quercus macrocarpa</i>
Bur-reed	<i>Sparganium</i> spp.
Buttonbush	<i>Cephalanthus occidentalis</i>
Canada bluejoint grass	<i>Calamagrostis canadensis</i>
Cardinal flower	<i>Lobelia cardinalis</i>
Carp	<i>Cyprinus carpio</i>
Cattail	<i>Typha latifolia</i> , <i>Typha angustifolia</i>
Cerulean warbler	<i>Dendroica cerulea</i>
Channel shiner	<i>Notropis wickliffi</i>
Clam shrimp	<i>Lycneus brachyunis</i>
Common buckthorn	<i>Rhamnus cathartica</i>
Common reed	<i>Phragmites australis</i>
Coontail	<i>Ceratophyllum demersum</i>
Cottonwood	<i>Populus deltoides</i>
Cuckoo flower	<i>Cardamine pratensis</i>
Curly pondweed	<i>Potamogeton crispus</i>
Deam's rockcress	<i>Arabis missouriensis</i> var <i>deamii</i>
Dogwood	<i>Cornus</i> spp.
Duckweed	<i>Lemna</i> spp.
Elm	<i>Ulmus</i> spp.
Elusive clubtail dragonfly	<i>Stylurus notatus</i>

Common Name	Scientific Name
Eurasian milfoil	<i>Myriophyllum spicatum</i>
False nettle	<i>Boehmeria cylindrica</i>
Flowering rush	<i>Butomus umbellatus</i>
Fowl mannagrass	<i>Glyceria striata</i>
Fox sedge	<i>Carex vulvinoidea</i>
Garlic mustard	<i>Alliaria petiolata</i>
Giant reed	<i>Phragmites australis</i>
Gizzard shad	<i>Dorosoma cepedianum</i>
Golden alexanders	<i>Zizia aurea</i>
Glossy buckthorn	<i>Rhamnus frangula</i>
Gray-headed coneflower	<i>Rudbekia laciniata</i>
Gray's sedge	<i>Carex grayi</i>
Green ash	<i>Fraxinus pennsylvanica</i>
Green dragon	<i>Arisaema dracontium</i>
Hackberry	<i>Celtis occidentalis</i>
Handsome sedge	<i>Carex formosa</i>
Hemlock	<i>Tsuga canadensis</i>
Hickory	<i>Carya ovata</i> , <i>Carya cordiformis</i>
Honeysuckle	<i>Lonicera</i> spp.
Hop sedge	<i>Carex lupulina</i>
Hornwort	<i>Ceratophyllum demersum</i>
Indian cucumber-root	<i>Madeola virginiana</i>
Jack pine	<i>Pinus banksiana</i>
Joe-pye-weed	<i>Eupatorium maculatum</i>
Jumpseed	<i>Polygonum virginianum</i>
Lake sedge	<i>Carex lacustris</i>
Lake sturgeon	<i>Acipenser fulvescens</i>
Large leetid damselflies	<i>Lestidae</i> spp.
Leafy white orchis	<i>Platanthera dilatata</i>
Marsh fern	<i>Thelypteris palustris</i>
Marsh valerian	<i>Valeriana sitchensis</i> ssp <i>uliginosa</i>
Mimic shiner	<i>Notropis volucellus volucellus</i>
Mississippi grass shrimp	<i>Palaemonetes kadiakensis</i>
Monkey flower	<i>Mimulus ringens</i>
Muskingum sedge	<i>Carex muskingumensis</i>
Oaks	<i>Quercus</i> spp.
Ostrich fern	<i>Matteucia</i> spp.
Panicled aster	<i>Aster lanceolatus</i>
Paper birch	<i>Betula papyrifera</i>
Plains clubtail dragonfly	<i>Gomphurus externus</i>
Poison sumac	<i>Rhus vernix</i>
Pond weed	<i>Potamogeton</i> spp.
Prairie dock	<i>Silphium laciniatum</i>
Pugnose minnow	<i>Notropis emiliae</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Red maple	<i>Acer rubrum</i>
Red oak	<i>Quercus rubra</i>
Red pine	<i>Pinus resinosa</i>
Prairie sunflower	<i>Helianthus pauciflorus</i>
Reed canarygrass	<i>Phalaris arundinacea</i>
River bulrush	<i>Scirpus fluviatilis</i>

Common Name	Scientific Name
River darter	<i>Percina shumardi</i>
River redhorse	<i>Moxostoma carinatum</i>
River shiner	<i>Notropis blennius</i>
Rough-winged swallows	<i>Stelgidopteryx serripennis</i>
Rusty crayfish	<i>Orconectes rusticus</i>
Scrub oak	<i>Quercus ellipsoidalis</i>
Sedges	<i>Carex</i> spp.
Sensitive fern	<i>Onoclea sensibilis</i>
Shoal chub	<i>Macrhybopsis aestivalis</i>
Shortnose gar	<i>Lepisosteus platostomus</i>
Silver maple	<i>Acer saccharinum</i>
Slenderhead darter	<i>Percina phoxocephala</i>
Snuffbox mussel	<i>Epioblasma triquetra</i>
Soft maple	<i>Acer saccharinum</i> , <i>Acer rubrum</i>
Soft-stem bulrush	<i>Scirpus validus</i>
Spatterdock	<i>Nuphar luteum</i>
Speckled chub	<i>Macrhybopsis aestivalis</i>
Spikerush	<i>Eleocharis</i> spp.
Stinging nettle	<i>Urtica dioica</i> ssp. <i>Gracilis</i>
Sugar maple	<i>Acer saccharum</i>
Swamp milkweed	<i>Asclepias incarnata</i>
Swamp white oak	<i>Quercus bicolor</i>
Tall bellflower	<i>Campanula americana</i>
Tamarack	<i>Larix laricina</i>
Tiger beetles	<i>Carabidae (Cicindelinae)</i>
Tuckerman's sedge	<i>Carex tuckermanii</i>
Water celery	<i>Vallisneria americana</i>
Water horsetail	<i>Equisetum fluvatile</i>
Water milfoil	<i>Myriophyllum spicatum</i>
Waterweed	<i>Elodea canadensis</i>
Western sand darter	<i>Ammocrypta clara</i>
White ash	<i>Fraxinus americana</i>
White cedar	<i>Thuja occidentalis</i>
White grass	<i>Leersia virginica</i>
White oak	<i>Quercus alba</i>
White pine	<i>Pinus strobus</i>
White snakeroot	<i>Eupatorium rugosum</i>
White water crowfoot	<i>Ranunculus aquatilis</i>
Wild rice	<i>Zizania aquatica</i>
Willow	<i>Salix</i> spp.
Winterberry holly	<i>Ilex verticillata</i>
Wire-leaved sedge	<i>Carex lasiocarpa</i>
Wood nettle	<i>Laportea canadensis</i>
Wood turtle	<i>Clemmys insculpta</i>
Woodland brome grass	<i>Bromus pubescens</i>
Yellow birch	<i>Betula alleghaniensis</i>
Yellow water buttercup	<i>Ranunculus (delphiniifolius) flabellaris</i>
Zebra mussel	<i>Dreissena</i> spp.

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